

## CLAIMS

What is claimed is:

1. A method for creating a radio frequency filter having an input, the method comprising the steps of:
  - 5 forming a transmission line having a characteristic impedance which increases at a first substantially exponential rate with respect to a distance from the input;  
coupling to the transmission line a plurality of resonators positioned at a plurality of locations along the transmission line and  
10 having resonant frequencies which decrease at a second substantially exponential rate with respect to the distance from the input; and  
obtaining an output signal at a point in the filter that produces a filter response having a corner frequency.
- 15 2. The method of claim 1, wherein the obtaining step comprises the step of obtaining multiple output signals at multiple physically separated points in the filter to produce multiple filter responses having different corner frequencies.

3. The method of claim 1, wherein the obtaining step comprises the steps of:

obtaining at least two output signals from at least two physically separated points in the filter; and

5 combining the at least two output signals to produce a band pass response.

4. The method of claim 1, wherein the forming step comprises the step of arranging the transmission line such that the characteristic impedance at a  
10 distal end of the transmission line divided by the characteristic impedance at the input is substantially equal to a desired upper operating frequency range limit divided by a desired lower operating frequency range limit.

15 5. The method of claim 1,

wherein the forming step comprises the step of forming a micro stripline transmission line, tapered such that the characteristic impedance increases at a predetermined substantially exponential rate with respect to the distance from the input; and

20 wherein the coupling step comprises the step of coupling a plurality of micro stripline stubs arranged such that, compared to a stub

closest to the input, each additional stub increases in length at said predetermined substantially exponential rate with respect to the distance from the input.

- 5 6. The method of claim 1, wherein the obtaining step comprises the step of obtaining the output signal through at least one of an electric, a magnetic, and an electromagnetic coupling to a resonator of the plurality of resonators.
- 10 7. The method of claim 1, wherein the obtaining step comprises the step of obtaining the output signal through at least one of an electric, a magnetic, and an electromagnetic coupling to the transmission line.
8. The method of claim 1, wherein the coupling step comprises the step of
- 15 forming the plurality of resonators such that the plurality of resonators have a substantially constant damping factor.
9. The method of claim 1, wherein the first substantially exponential rate and the second substantially exponential rate are substantially equal to
- 20 one another.

10. The method of claim 1, further comprising the step of arranging the multi-band radio frequency filter such that the filter is a model of a basilar membrane of a mammalian cochlea.

5 11. A radio frequency filter, the filter comprising:

an input for receiving an input signal;

a transmission line coupled to the input, the transmission line

having a characteristic impedance which increases at a first substantially exponential rate with respect to a distance from the input;

10 a plurality of resonators coupled to the transmission line, the resonators positioned at a plurality of points along the transmission line and having resonant frequencies which decrease at a second substantially exponential rate with respect to the distance from the input; and

an output coupled to a point in the filter that produces a filter

15 response having a corner frequency.

12. The filter of claim 11, further comprising multiple outputs coupled to multiple physically separated points in the filter for producing multiple output signals with multiple filter responses having different corner  
20 frequencies.

13. The filter of claim 11, further comprising:

at least two outputs coupled to at least two physically separated points in the filter for producing at least two output signals; and

a combiner coupled to the at least two outputs for combining the at

5 least two output signals to establish a band pass response.

14. The filter of claim 11, wherein the transmission line is arranged and formed such that the characteristic impedance at a distal end of the transmission line divided by the characteristic impedance at the input is  
10 substantially equal to a desired upper operating frequency range limit divided by a desired lower operating frequency range limit.

15. The filter of claim 11,

wherein the transmission line is arranged and formed as a micro  
15 stripline transmission line, tapered such that the characteristic impedance increases at a predetermined substantially exponential rate with respect to the distance from the input; and

wherein the plurality of resonators are formed as a plurality of micro stripline stubs arranged such that, compared to a stub closest to the  
20 input, each additional stub increases in length at said predetermined substantially exponential rate with respect to the distance from the input.

16. The filter of claim 11, wherein the output comprises an element for obtaining the output signal through at least one of an electric, a magnetic, and an electromagnetic coupling to a resonator of the plurality of  
5 resonators.

17. The filter of claim 11, wherein the output comprises an element for obtaining the output signal through at least one of an electric, a magnetic, and an electromagnetic coupling to the transmission line.  
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18. The filter of claim 11, wherein the plurality of resonators are arranged and formed to have a substantially constant damping factor.

19. The filter of claim 11, wherein the first substantially exponential rate  
15 and the second substantially exponential rate are substantially equal to one another.

20. The filter of claim 11, arranged such that the filter is a model of a basilar membrane of a mammalian cochlea.  
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21. A radio frequency filter, the filter comprising:

an input for receiving an input signal;

a filter element modeled on a basilar membrane of a mammalian cochlea; and

5 an output coupled to a point in the filter that produces a filter response.

22. A radio frequency device, comprising:

at least one of a transmitter and a receiver; and

10 a radio frequency filter, the filter comprising:

an input for receiving an input signal;

a filter element modeled on a basilar membrane of a mammalian cochlea; and

an output coupled to a point in the filter that produces a  
15 filter response, the output further coupled to the at least one of the transmitter and the receiver for providing an output signal thereto.

23. The radio frequency device of claim 22, wherein the radio frequency filter is arranged such that at least one of a center frequency and a

20 bandwidth of the filter are controllable.